

**UCRL-JC-126448 Abs**

**Color Image Analysis of Contaminants and Bacteria Transport in Porous Media**

Mehdi Rashidi  
Environmental Programs Directorate  
Lawrence Livermore National Laboratory  
University of California, Livermore, CA 94550, USA  
Email: rashidi1@llnl.gov  
(510) 423-3521  
(510) 423-2042 fax

Jamshid Dehmeshki and Farhang Daemi  
Centre for Industrial and Medical Informatics  
University of Nottingham, Nottingham, NG7 2RQ, England  
Email: dehmeshki1@llnl.gov & mfd@cs.nott.ac.uk  
+44-115-9568990  
+44-115-9568991 fax

Transport of contaminants and bacteria in aqueous heterogeneous saturated porous systems have been studied experimentally using a novel fluorescent microscopic imaging (FMI) technique. The approach involves color visualization and quantification of bacterium and contaminant distributions within a transparent porous column. By introducing stained live bacteria and an organic dye as a contaminant into the column and illuminating the porous regions with a planar sheet of laser beam, contaminant and bacterial transport processes through the porous medium can be observed and measured microscopically. A computer controlled color CCD camera is used to record the fluorescent images as a function of time. These images are recorded by a frame accurate high resolution VCR and are then analyzed using a color image analysis code written in our laboratories. The color images are digitized this way and simultaneous concentration distributions of both contaminant and bacterium are evaluated as a function of time and pore characteristics. The approach provides a unique dynamic probe to observe these transport processes microscopically. These results are extremely valuable in in-situ bioremediation problems since microscopic particle-contaminant-bacterium interactions are the key to understanding and optimization of these processes.

---

Portions of this work were performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-Eng-48.